REMARKS

The Office Action mailed February 6, 2007, and made final, has been carefully reviewed and the following remarks are made in consequence thereof.

Claims 1, 3-15, 17-29 are now pending in this application. Claims 1, 3-15, 17-29 stand rejected. Claims 2, 16, 30, and 31 have been canceled.

The rejection of Claims 1-29 under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement, is respectfully traversed. Claims 1 and 15 have been amended to address the issue raised by the Examiner in the Office Action. For the reasons set forth above, Applicants respectfully request that the Section 112 rejection of Claims 1-29 be withdrawn.

The rejection of Claims 1, 2, 5-9, 12-16, 19-23, 28, and 29 under 35 U.S.C. § 103(a) as being unpatentable over Bidaud (U.S. Patent No. 6,347,265) in view of Ford (U.S. Patent No. 6,211,821) is respectfully traversed.

Bidaud describes a track analyzer included on a vehicle (28) traveling on a track (10) that includes a vertical gyroscope (20) for determining a grade and an elevation of the track. A rate gyroscope (50) determines a curvature of the track. A speed determiner (70) determines a speed of the vehicle relative to the track. A distance determiner (91) determines a distance the vehicle has traveled along the track. Also, the direction in which the vehicle is moving, meaning forward or backward, is determined by whether the phase of a first plate (112) leads/lags the phase of a second plate (114). Notably, Bidaud does not describe nor suggest determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers using an integer ambiguity, wherein *an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude.*

Ford describes a heading (multipath) sensor (70) including a primary receiver (45) which is configured to receive a positioning signal (51) from a primary antenna (41). The heading sensor also includes a secondary receiver (47) configured to receive a positioning signal (53) from a secondary antenna (43). Both receivers send an output (57 and 59) to a computational unit (60), respectively. The heading sensor uses differences in carrier

observations made at the primary antenna and the secondary antenna to generate a baseline vector (49) and produce five double difference observations. Ford further describes at Column 4, lines 40-42 that the number of double-difference candidates "is limited by imposing constraints on the baseline length, the pitch, the azimuth, or the velocity of the vessel or flight vehicle." However, Ford does not describe nor suggest determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers using an integer ambiguity, wherein *an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude.*

Claim 1 recites a method for determining at least one of motion and location parameters of a railroad locomotive, with the locomotive oriented with either end thereof in the lead in the direction of travel of the locomotive, wherein the method comprises the steps of "providing at least two satellite signal receivers on the locomotive at spaced locations along the length of the locomotive . . . determining a vector distance $\vec{\mathbf{d}}$ between the two satellite signal receivers using an integer ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude . . . determining a set of phase differences between satellite reference signals received by satellite receivers . . . determining an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using the set of phase differences between the satellite reference signals and the vector distance $\vec{\mathbf{d}}$."

Neither Bidaud nor Ford, considered alone or in combination, describe nor suggest a method for determining at least one of motion and location parameters of a railroad locomotive, as is recited in Claim 1. Specifically, neither Bidaud nor Ford, considered alone or in combination, describe nor suggest, a method including determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers using an integer ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude. Rather, in contrast to the present invention, Bidaud describes a track analyzer that uses a gyroscope to determine a grade and an elevation of a track, a curvature of the track, a speed of a vehicle relative to the track, a distance the vehicle has traveled along the track, and the direction in which the vehicle is moving, and

Ford describes a system that utilizes multipath error estimates to determine a heading. Ford also describes limiting the number of double-difference candidates by imposing constraints on the baseline length, the pitch, the azimuth, or the velocity of the vessel or flight vehicle. Applicant submit that describing limiting the number of double-difference candidates by imposing constraints on the baseline length, the pitch, the azimuth, or the velocity of the vessel or flight vehicle does not describe nor suggest resolving an initial integer ambiguity by consulting a database that provides an initial heading and track grade as a function of latitude and longitude. Accordingly, Applicants submit that Claim 1 is patentable over Bidaud and Ford.

Claim 2 has been canceled. Claims 5-9, and 12-14 depend, directly or indirectly, from independent Claim 1. When the recitations of Claims 5-9, and 12-14 are considered in combination with the recitations of Claim 1, Applicants submit that Claims 5-9, and 12-14 likewise are patentable over Bidaud in view of Ford.

Claim 15 recites an apparatus for determining at least one of motion and location parameters of a railroad locomotive to detect curves and reduce track wear, with the locomotive oriented with either end of the locomotive in the lead in the direction of travel of the locomotive, wherein the apparatus comprises "at least two phase-locking satellite receivers configured to reference signals received from a set of satellites . . . a processor configured to . . . determine a set of phase differences between the reference signals received by said satellite receivers . . . determine a vector distance $\vec{\mathbf{d}}$ between the two satellite receivers using an integer ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude . . . determine an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using the set of phase differences between the reference signals and the vector distance $\vec{\mathbf{d}}$."

Neither Bidaud nor Ford, considered alone or in combination, describe nor suggest an apparatus for determining at least one of motion and location parameters of a railroad locomotive to detect curves and reduce track wear, as is recited in Claim 15. Specifically, neither Bidaud nor Ford, considered alone or in combination, describe nor suggest an apparatus that determines a vector distance $\vec{\mathbf{d}}$ between two satellite receivers using an integer

ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude. Rather, in contrast to the present invention, Bidaud describes a track analyzer that uses a gyroscope to determine a grade and an elevation of a track, a curvature of the track, a speed of a vehicle relative to the track, a distance the vehicle has traveled along the track, and the direction in which the vehicle is moving, and Ford describes a system that utilizes multipath error estimates to determine a heading. Ford also describes limiting the number of double-difference candidates by imposing constraints on the baseline length, the pitch, the azimuth, or the velocity of the vessel or flight vehicle. Applicant submit that describing limiting the number of double-difference candidates by imposing constraints on the baseline length, the pitch, the azimuth, or the velocity of the vessel or flight vehicle does not describe nor suggest resolving an initial integer ambiguity by consulting a database that provides an initial heading and track grade as a function of latitude and longitude. Accordingly, Applicants submit that Claim 15 is patentable over Bidaud and Ford.

Claim 16 has been canceled. Claims 19-23, 28, and 29 depend, directly or indirectly, from independent Claim 15. When the recitations of Claims 19-23, 28, and 29 are considered in combination with the recitations of Claim 15, Applicants submit that Claims 19-23, 28, and 29 likewise are patentable over Bidaud in view of Ford.

For at least the reasons set forth above, Applicants respectfully requests that the Section 103 rejection of Claims 1, 2, 5-9, 12-16, 19-23, 28, and 29 be withdrawn.

The rejection of Claims 3, 4, 17, and 18 under 35 U.S.C. § 103(a) as being unpatentable over Bidaud in view of Ford as applied to Claims 1, 2, 15, and 16 above, and further in view of Wilson (U.S. Patent No. 6,313,788) is respectfully traversed.

Bidaud and Ford are described above. Wilson describes a method for determining inter-antenna baselines using an antenna configuration (200) including a pair of relatively closely spaced (D1) antennas and other pairs of distant (D2) antennas. The closely spaced pair provides a short baseline having an integer ambiguity that may be searched exhaustively to identify the correct set of integers. Specifically, as is recited in Column 8, lines 40-43, "the exact number of cycles of the radio source carrier wave 310 may be used to reliably resolve the integer ambiguity 380 and thereafter determine the baseline." As such, Wilson

describes using radio wave cycles to exhaustively search for and identify integer ambiguities. In contrast the present invention describes determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers using an integer ambiguity, *wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude.* Applicants submit that describing using radio wave cycles to exhaustively search for and identify integer ambiguities does not describe nor suggest resolving an initial integer ambiguity by consulting a database that provides an initial heading and track grade as a function of latitude and longitude.

Claim 1 recites a method for determining at least one of motion and location parameters of a railroad locomotive, with the locomotive oriented with either end thereof in the lead in the direction of travel of the locomotive, wherein the method comprises the steps of "providing at least two satellite signal receivers on the locomotive at spaced locations along the length of the locomotive . . . determining a vector distance $\vec{\mathbf{d}}$ between the two satellite signal receivers using an integer ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude . . . determining a set of phase differences between satellite reference signals received by satellite receivers . . . determining an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using the set of phase differences between the satellite reference signals and the vector distance $\vec{\mathbf{d}}$."

No combination of Bidaud, Ford, and Wilson, describes or suggests a method for determining at least one of motion and location parameters of a railroad locomotive, as is recited in Claim 1. Specifically, no combination of Bidaud, Ford, and Wilson, describes or suggests a method including determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers using an integer ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude. Rather, in contrast to the present invention, Bidaud describes a track analyzer that uses a gyroscope to determine a grade and an elevation of a track, a curvature of the track, a speed of a vehicle relative to the track, a distance the vehicle has traveled along the track, and the direction in which the vehicle is moving, Wilson describes using radio wave cycles to

exhaustively search for and identify integer ambiguities, and Ford describes a system that utilizes multipath error estimates to determine a heading. Ford also describes limiting the number of double-difference candidates by imposing constraints on the baseline length, the pitch, the azimuth, or the velocity of the vessel or flight vehicle. Applicant submit that describing limiting the number of double-difference candidates by imposing constraints on the baseline length, the pitch, the azimuth, or the velocity of the vessel or flight vehicle does not describe nor suggest resolving an initial integer ambiguity by consulting a database that provides an initial heading and track grade as a function of latitude and longitude. Accordingly, for at least the reasons set forth above, Claim 1 is submitted to be patentable over Bidaud in view of Ford and Wilson.

Claims 3 and 4 depend, directly or indirectly, from independent Claim 1. When the recitations of Claims 3 and 4 are considered in combination with the recitations of Claim 1, Applicants submit that Claims 3 and 4 likewise are patentable over Bidaud in view of Ford and Wilson.

Claim 15 recites an apparatus for determining at least one of motion and location parameters of a railroad locomotive to detect curves and reduce track wear, with the locomotive oriented with either end of the locomotive in the lead in the direction of travel of the locomotive, wherein the apparatus comprises "at least two phase-locking satellite receivers configured to reference signals received from a set of satellites . . . a processor configured to . . . determine a set of phase differences between the reference signals received by said satellite receivers . . . determine a vector distance $\vec{\mathbf{d}}$ between the two satellite receivers using an integer ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude . . . determine an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using the set of phase differences between the reference signals and the vector distance $\vec{\mathbf{d}}$."

No combination of Bidaud, Ford, and Wilson, describes or suggests an apparatus for determining at least one of motion and location parameters of a railroad locomotive to detect curves and reduce track wear, as is recited in Claim 15. Specifically, no combination of Bidaud, Ford, and Wilson, describes or suggests an apparatus that determines a vector

distance $\vec{\mathbf{d}}$ between two satellite receivers using an integer ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude. Rather, in contrast to the present invention, Bidaud describes a track analyzer that uses a gyroscope to determine a grade and an elevation of a track, a curvature of the track, a speed of a vehicle relative to the track, a distance the vehicle has traveled along the track, and the direction in which the vehicle is moving, Wilson describes using radio wave cycles to exhaustively search for and identify integer ambiguities, and Ford describes a system that utilizes multipath error estimates to determine a heading. Ford also describes limiting the number of double-difference candidates by imposing constraints on the baseline length, the pitch, the azimuth, or the velocity of the vessel or flight vehicle. Applicant submit that describing limiting the number of double-difference candidates by imposing constraints on the baseline length, the pitch, the azimuth, or the velocity of the vessel or flight vehicle does not describe nor suggest resolving an initial integer ambiguity by consulting a database that provides an initial heading and track grade as a function of latitude and longitude. Accordingly, for at least the reasons set forth above, Claim 15 is submitted to be patentable over Bidaud in view of Ford and Wilson.

Claims 17 and 18 depend, directly or indirectly, from independent Claim 15. When the recitations of Claims 17 and 18 are considered in combination with the recitations of Claim 15, Applicants submit that Claims 17 and 18 likewise are patentable over Bidaud in view of Ford and Wilson.

For at least the reasons set forth above, Applicants respectfully requests that the Section 103 rejection of Claims 3, 4, 17, and 18 be withdrawn.

The rejection of Claims 10, 11, and 24-27 under 35 U.S.C. § 103(a) as being unpatentable over Bidaud in view of Ford as applied to Claims 1, 5, 15, and 19 above, and further in view of Kumar (U.S. Patent No. 5,896,947) is respectfully traversed.

Bidaud and Ford are described above. Kumar describes a method for simultaneously lubricating the rail gage side (RAGS) and wheel flanges ahead of a locomotive's (1) tractive wheels and lubricating the top of the rail (TOR) behind the tractive wheels to reduce the resistance of the trailing cars and reduce the locomotive wheel flange wear. The method includes controlling both lubricating units with the same computer controller (2) when a

single locomotive (1) is used and two controllers (2F, 2R) located in two different locomotives (1) in the case of a train consist (10). Notably, Kumar does not describe nor suggest determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers using an integer ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude.

Claim 1 recites a method for determining at least one of motion and location parameters of a railroad locomotive, with the locomotive oriented with either end thereof in the lead in the direction of travel of the locomotive, wherein the method comprises the steps of "providing at least two satellite signal receivers on the locomotive at spaced locations along the length of the locomotive . . . determining a vector distance $\vec{\mathbf{d}}$ between the two satellite signal receivers using an integer ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude . . . determining a set of phase differences between satellite reference signals received by satellite receivers . . . determining an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using the set of phase differences between the satellite reference signals and the vector distance $\vec{\mathbf{d}}$."

No combination of Bidaud, Ford, and Kumar, describes or suggests a method for determining at least one of motion and location parameters of a railroad locomotive, as is recited in Claim 1. Specifically, no combination of Bidaud, Ford, and Kumar, describes or suggests a method including determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers using an integer ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude. Rather, in contrast to the present invention, Bidaud describes a track analyzer that uses a gyroscope to determine a grade and an elevation of a track, a curvature of the track, a speed of a vehicle relative to the track, a distance the vehicle has traveled along the track, and the direction in which the vehicle is moving, Kumar describes a method for simultaneously lubricating the rail gage side (RAGS) and wheel flanges ahead of a locomotive's tractive wheels and lubricating the top of the rail (TOR) behind the locomotive's tractive wheels, and Ford describes a system that utilizes multipath error estimates to determine a heading. Ford

also describes limiting the number of double-difference candidates by imposing constraints on the baseline length, the pitch, the azimuth, or the velocity of the vessel or flight vehicle. Applicant submit that describing limiting the number of double-difference candidates by imposing constraints on the baseline length, the pitch, the azimuth, or the velocity of the vessel or flight vehicle does not describe nor suggest resolving an initial integer ambiguity by consulting a database that provides an initial heading and track grade as a function of latitude and longitude. Accordingly, for at least the reasons set forth above, Claim 1 is submitted to be patentable over Bidaud in view of Ford and Kumar.

Claims 10 and 11 depend, directly or indirectly, from independent Claim 1. When the recitations of Claims 10 and 11 are considered in combination with the recitations of Claim 1, Applicants submit that Claims 10 and 11 likewise are patentable over Bidaud in view of Ford and Kumar.

Claim 15 recites an apparatus for determining at least one of motion and location parameters of a railroad locomotive to detect curves and reduce track wear, with the locomotive oriented with either end of the locomotive in the lead in the direction of travel of the locomotive, wherein the apparatus comprises "at least two phase-locking satellite receivers configured to reference signals received from a set of satellites . . . a processor configured to . . . determine a set of phase differences between the reference signals received by said satellite receivers . . . determine a vector distance $\vec{\mathbf{d}}$ between the two satellite receivers using an integer ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude . . . determine an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using the set of phase differences between the reference signals and the vector distance $\vec{\mathbf{d}}$."

No combination of Bidaud, Ford, and Kumar describes or suggests an apparatus for determining at least one of motion and location parameters of a railroad locomotive to detect curves and reduce track wear, as is recited in Claim 15. Specifically, no combination of Bidaud, Ford, and Kumar, describes or suggests an apparatus that determines a vector distance $\vec{\mathbf{d}}$ between two satellite receivers using an integer ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and

track grade as a function of latitude and longitude. Rather, in contrast to the present invention, Bidaud describes a track analyzer that uses a gyroscope to determine a grade and an elevation of a track, a curvature of the track, a speed of a vehicle relative to the track, a distance the vehicle has traveled along the track, and the direction in which the vehicle is moving, Kumar describes a method for simultaneously lubricating the rail gage side (RAGS) and wheel flanges ahead of a locomotive's tractive wheels and lubricating the top of the rail (TOR) behind the locomotive's tractive wheels, and Ford describes a system that utilizes multipath error estimates to determine a heading. Ford also describes limiting the number of double-difference candidates by imposing constraints on the baseline length, the pitch, the azimuth, or the velocity of the vessel or flight vehicle. Applicant submit that describing limiting the number of double-difference candidates by imposing constraints on the baseline length, the pitch, the azimuth, or the velocity of the vessel or flight vehicle does not describe nor suggest resolving an initial integer ambiguity by consulting a database that provides an initial heading and track grade as a function of latitude and longitude. Accordingly, for at least the reasons set forth above, Claim 15 is submitted to be patentable over Bidaud in view of Ford and Kumar.

Claims 24-27 depend, directly or indirectly, from independent Claim 15. When the recitations of Claims 24-27 are considered in combination with the recitations of Claim 15, Applicants submit that Claims 24-27 likewise are patentable over Bidaud in view of Ford and Kumar.

For at least the reasons set forth above, Applicants respectfully requests that the Section 103 rejection of Claims 10, 11, and 24-27 be withdrawn.

In view of the foregoing amendment and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully submitted,

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